

Section 02050

Surveying

PART 1 GENERAL

1.1 SCOPE

This section includes the requirements for surveying, including but not limited to:

- A. Establish survey benchmarks and baselines.
- B. Setting limits and boundaries of construction activities.
- C. Perform surveys for:
 - 1. Verification of the existing conditions.
 - 2. Support surveys during the construction activities.
 - 3. Measurement and payment.
 - 4. Conformance checks.
- D. Prepare and furnish as-built construction drawings.

1.2 RELATED SECTIONS AND PLANS

- A. Section 02275 - Erosion and Sediment Control.
- B. Part 8 - Environmental Health and Safety, and Training Requirements.

1.3 REFERENCES

National Geodetic Survey Standards.

1.4 QUALIFICATION

- A. Oversight for the survey work shall be provided and certified by a Land Surveyor licensed in the State of Ohio.
- B. Survey work shall be performed under the direct supervision of a person who has at least 5 years of experience in construction surveying.
- C. Work performed in referencing or re-establishment of FDF or United States survey monuments shall be stamped/certified by an Ohio licensed land surveyor.

1.5 SUBMITTALS

- A. Submit qualifications for land surveyor licensed in the State of Ohio to the Construction Manager within 10 calendar days from Notice to Proceed for review and approval.
- B. On request by the Construction Manager, submit documentation verifying accuracy of survey work.
- C. Submit survey notes, field notes, sketches and drawings for the following surveys:
 - 1. Preliminary surveys.
 - 2. Prior to commencement of construction activities.
 - 3. Intermediate surveys.
 - 4. Before winter break(s) and at completion of the Contract.
 - 5. At completion of excavation of the Southern Waste Units (SWUs) and stockpiles including completion of Above WAC excavation, lead contaminated soil excavation, Excavation Grading Plan-1, Excavation Grading Plan-2 and Excavation Grading Plan-3.
 - 6. Measurement and payment surveys.
 - 7. Final surveys.
- D. Submit two (2) copies of field notes, sketches and drawings prepared by the licensed Land Surveyor, to the Construction Manager on a weekly basis or upon request by the Construction Manager. Field notes shall be legibly recorded on standardized field note books. Notation shall be consistently applied to survey

work; the stake marking format and the field book notation shall be compatible. Identify survey benchmarks on the field notes, sketches and drawings.

- E. Upon completion of the survey work, provide the Construction Manager the original field note books, layout, computations, sketches and certified drawings in Intergraph Microstation (version 5.0 or later) ".dgn" files.
- F. Submittal requirements for the environmental health and safety requirements shall be as specified in Part 8.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain on site a complete and accurate log documenting survey work as it progresses.
- B. Maintain on site drawings clearly showing survey benchmarks and baselines.
- C. Maintain on site an accurate and current set of red-line drawings with as-built locations. Data shall be incorporated within one week of completion of the respective construction activity.

1.7 EXAMINATION OF THE EXISTING CONDITIONS

- A. Prior to the start of site preparation and excavation of the impacted material, verify the accuracy of the existing conditions shown on the Construction Drawings. Immediately notify the Construction Manager in writing of deviations from the existing conditions indicated on the Construction Drawings.
- B. Verify the existing structures, utilities, wells and associated protection, topography, erosion and sediment control measures, construction and radiological control fences, retention basins and appurtenances and drainage features shown on the Construction Drawings and notify the Construction Manager of any differences or conflicts with proposed work. Stake the locations of excavations and review proposed work with the Construction Manager in the field, as shown on the Construction Drawings.

1.8 SURVEY BENCHMARKS

- A. Locate and verify benchmarks as shown on the Construction Drawings in accordance with this Section.
- B. Protect and preserve benchmarks.
- C. Replace disturbed or damaged survey benchmarks at no additional cost to FDF.

1.9 HEALTH AND SAFETY REQUIREMENTS

Environmental Health and Safety, and Training requirements shall be as specified in Part 8.

PART 2 PRODUCTS

- A. Provide materials as required to perform the surveys, including, but not limited to: instruments, tapes, rods, measures, mounts, tripods, stakes, hubs, nails, ribbon, and other reference markers.
- B. Survey instruments shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.001 feet with a setting accuracy of 8 seconds.

PART 3 EXECUTION

3.1 GENERAL

- A. Establish elevations, lines, and levels. Locate and lay out by instrumentation and similar appropriate means. Topographic contours shall be shown to nearest foot. Field run data shall be taken to adjacent existing undisturbed area (100 ft. minimum overlap) to create a smooth contour transition.
- B. Maintain accurate and complete notes of surveys:
 - 1. Handwritten survey notes and information shall be documented in survey field books. A copy of the numbered, dated and signed field book pages

shall be given to the Construction Manager weekly, or upon request, for use in reviewing the work.

2. Electronically collected field survey information shall be collected and backup equipment shall be available in the event of equipment malfunction.
 - a. Electronic format for printed output of data collectors field survey notes shall be compatible with the field book notation format.
 - b. Electronic format for printed output of data collectors field work shall be compatible with the Contractor's and Construction Manager's computer equipment and software for reviewing the work. A copy of the data disk shall be submitted to the Construction Manager monthly or upon request.
- C. The precision of horizontal and vertical control shall meet or exceed Third-Order, Class I and Third-Order accuracies, respectively, as defined by National Geodetic Survey Standards. Elevation shall be referenced to National Geodetic Vertical Datum (NGVD) of 1929 and horizontal coordinates to North American Datum (NAD) 1983.
- D. Conformance check surveys for elevation and for horizontal coordinates shall be to the nearest 0.01 foot and for angles to the nearest 20 seconds.
- E. Measurement and payment surveys for elevation and for horizontal distance shall be to the nearest 0.1 foot +/- 0.05 foot.
- F. Perform construction layout surveys in advance of scheduled construction activities. The Contractor is responsible for rework and/or construction delays caused by survey or staking errors.
- G. Set grade stakes and slope stakes in accordance with accepted surveying practices.
- H. Set grade stakes for construction activities as the work progresses.
- I. Establish temporary survey benchmarks, as necessary, to support construction activities.

J. Benchmarks, Accuracy and Documentation:

1. Record the following information in survey notebooks for each benchmark established:
 - a. Designation of survey benchmark;
 - b. Coordinates based on State Planer NAD;
 - c. Elevation based on NGVD;
 - d. Date of establishment;
 - e. Description and sketch of survey benchmark location; and
 - f. Survey benchmarks shall be referenced to a minimum of three features that can be seen from the survey benchmark.
2. Document survey work in the field notebooks using the format and procedures described below:
 - a. Title and consecutive notebook number on the front cover;
 - b. Consecutively numbered pages;
 - c. Table of contents, indicated by survey task, on the first numbered page;
 - d. Legend indicating symbols and abbreviations used in survey notes;
 - e. Names of survey team for each task;
 - f. Notes on weather, equipment, etc.;
 - g. Date and time on each page to indicate when work was recorded;
 - h. Notes in a uniform character such that they can be interpreted and used by anyone with survey knowledge;
 - i. Description and/or sketches of the existing survey control used.

3.2

SUPPORT SURVEYS

A. Preliminary Surveys:

1. Verify location of the existing survey benchmarks and the existing conditions specified in this Section prior to starting work.
2. Perform topographic surveys of areas to be excavated prior to construction activities.
3. Establish location of benchmarks required for locating baseline grid. Establish baselines and grid as shown on the Construction Drawings.
4. Establish location for the installation of the erosion and sediment control measures specified in Section 02275.
5. Establish limits of excavation at the SWU and at the stockpiles. Maximum staking interval shall be 50 feet unless otherwise approved by the Construction Manager.
6. Perform surveys for conformance checks as specified in this Section.

B. Intermediate Surveys:

1. Perform surveys during progress of the construction activities to verify the accuracy of field work and as directed by the Construction Manager.
2. Perform surveys for measurement and periodic progress payment as specified in this Section.
3. Perform surveys during progress of excavation to confirm limits of the excavation. In areas of above WAC excavation and lead contaminated soil excavation, perform surveys at each lift.
4. Perform conformance check surveys as specified in this Section.

C. Final Surveys:

1. Final topographic survey shall be at minimum 50 foot intervals or as required to define the topography. Additionally, the following points shall be surveyed and noted as applicable.
 - a. Grade breaks.
 - b. Points of horizontal curvature and tangency.
 - c. Ditches, pipes and channels: Stake ditches, channels and culverts such that layout remains undisturbed during construction.
 - d. Limits of final excavation.

2. Perform survey for conformance checks as specified in this Section.
3. Perform survey for final measurement and payment.

3.3 SURVEYS FOR MEASUREMENT AND PAYMENT

- A. Perform surveys for periodic progress payments and final payment to determine quantities of work.
- B. Calculate and certify quantities of work and submit survey notes and calculations to the Construction Manager for review, evaluation and payment.

3.4 SURVEYS FOR CONFORMANCE CHECKS

Perform conformance check surveys upon completion of a given construction activity. Provide the following minimum spacings and locations for survey points:

- A. A line of survey points spaced not more than 50 feet apart shall be taken, including along grade breaks (this will include the inside edge and outside edge of any bench on a slope).
- B. A line of survey points spaced not more than 50 feet apart shall be taken at the top of any pipes and any appurtenances, and at the top and invert of any storm culverts.

END OF SECTION

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